Asbestos Compliance and Retrospective Risk Analysis

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London
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HSE
Agenda

- Projected mesotheliomas
- Factors reducing exposure
- Factors which could inhibit future reduction
- Retrospective Risk Analysis
- Sentencing Guidelines
- Suggested boundaries on harm risk categories
- Final messages
Projections of Annual GB Mesothelioma Mortality
(From HSE statistics 2017)

Mesothelioma in Great Britain: annual actual and predicted deaths

Substantial increase in annual deaths due to asbestos exposures prior to 1980

Projected: 2,500 per year until 2020

Shaded area represents the upper and lower prediction interval
Evidence of Asbestos Exposure Reduction:
Average Amphibole Lung Burden by Period of Birth

Figure 5: National mesothelioma mortality and average amphibole asbestos lung burdens* in Britain by period of birth (million fibres/gm longer than 5 microns)
Regulatory and other Factors ("Leading Indicators?") affecting Asbestos Exposure include:

- Prohibition of asbestos use:
  - Crocidolite 1970, Amosite 1980s, All ACMs 1999
- Prevention of exposure (specific duty 1983)
- Changes in work practices/control:
  - eg wet stripping, power tool reduction, training, awareness
- Licensing regime
- Tighter Control Limits
- Duty-to-manage
- Changes in nature of materials being removed/disturbed
  - eg less sprayed coating/more AC, artex
- Enforcement action
HSE Asbestos Enforcement Action under CAR (2007-2016)

Improvement Notices (~2700)

Prohibition Notices (~1950)

Successful Prosecutions (~320)

CAR Reg 4 = DTM
5 = Identification
10 = Training
11 = Exposure
16 = Spread
Warning: Predicted Mesothelioma Deaths from 2045-2100
(from CAR 2012, PIR 2017)

Figure 1 – Predicted annual deaths and exposures from the different scenarios

*Relative changes in annual population asbestos exposure are used to predict subsequent mesothelioma mortality in the HSE model; the absolute scaling of the exposure profile is arbitrary in this chart.

Source: HSE Mesothelioma Projections Model
Factors which could inhibit future rate of decline in exposure and disease

- Employer’s ignorance/omissions/poor compliance
- Worker’s complacency regarding risks
- Worker’s unreliable skill in identifying ACMs
- Impact of Retrospective Risk Analysis (RRA)
  - Quantitative calculation of future risk of developing disease based on individual exposure incidents
Pause here: RRA

- Retrospective Risk Analysis
  - What is it?
  - Why is it possible?
RRA: What is it?

- The calculation of the “exposure dose” and “risk” for individuals associated with an asbestos incident.
- Risk calculation uses widely accepted exposure response models (e.g., Hodgson and Darnton) which take into account age, gender, and smoking habit.
- RRAs purpose (claimed in advertising/reports):
  - To provide reassurance/guidance to individuals on the level of exposure/risk from specific incidents.
RRA is possible because….

• Asbestos is a cumulative hazardous agent

• Risk of developing disease is “made-up” of a series of exposures (fibre level x duration)(doses)

• Recognised correlation between exposure dose and probability of developing disease:
  – Can determine “lifetime risk” from exposure doses

• So can examine the implications of individual incidents on lifetime risks
Mesothelioma Risk

One uncontrolled exposure will increase his risk (even if not materially)
Mesothelioma Risk

Repealed exposure events will continually increase his risk

Figures for illustration only
Exposure assessment: “Refurbishment” Worker

What might asbestos exposure consist of during a working year?

Example for illustrative purposes only
Exposure assessment: “Refurbishment” Worker

What might exposure consist of during a working year? (Generally unknown and unrecorded except for “incident”?)

![Graph showing intensity of exposure over working days over 1 year with marked thresholds 0.014 f/ml yr and <0.001 f/ml yr]
• Danger that failure to prevent or identify other exposure incidents:
  – Risks will be underestimated

• What is the incentive to control?
New Sentencing Guidelines and RRA:

“The Health and Safety Offences, Corporate Manslaughter and Food Safety and Hygiene Offences: Definitive Guideline issued by the Sentencing Council”

• Applies from 1 February 2016

• England and Wales:
  • Mandatory for Courts to follow
  • Advisory in Scotland

• Requires the Court to apply a step-wise approach to sentencing: Must consider:
  • Culpability (Extent of compliance)
  • “Harm risked” (Health effect/outcome)
  • “Likelihood of harm occurring” (RRA)
  • “Size” (ie turnover) of company
Sentencing Guidelines: Process Summary for the Court

Found/Pled GUILTY

Establish “Harm Risked” Level A, B or C A=Death

Establish “Likelihood of harm arising” High, Medium or Low (RRA)

Derive “Harm Category” (levels 1-4)

Level of Fine based on company turnover

Establish level of culpability Very high, High, Medium or Low
Harm

- The offence is in creating a risk of harm:
  - Actual harm is not an ingredient of health and safety offences

- Allows long latency diseases to be taken into account
<table>
<thead>
<tr>
<th>Health outcome</th>
<th>Seriousness of harm risked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level A</td>
</tr>
<tr>
<td></td>
<td>• Death</td>
</tr>
<tr>
<td></td>
<td>• Physical or mental impairment resulting in lifelong dependency on third party care for basic needs</td>
</tr>
<tr>
<td></td>
<td>• Significantly reduced life expectancy</td>
</tr>
<tr>
<td></td>
<td>Level B</td>
</tr>
<tr>
<td></td>
<td>• Physical or mental impairment, not amounting to Level A, which has a substantial and long-term effect on the sufferer’s ability to carry out normal day-to-day activities or on their ability to return to work</td>
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<tr>
<td></td>
<td>• A progressive, permanent or irreversible condition</td>
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<td></td>
<td>Level C</td>
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<td></td>
<td>• All other cases not falling within Level A or Level B</td>
</tr>
</tbody>
</table>
Harm: “Likelihood of harm occurring” (ie probability)

<table>
<thead>
<tr>
<th>Health outcome</th>
<th>Level A</th>
</tr>
</thead>
<tbody>
<tr>
<td>High likelihood of harm</td>
<td>Harm category 1</td>
</tr>
<tr>
<td></td>
<td>- Death</td>
</tr>
<tr>
<td></td>
<td>- Physical or mental impairment resulting in lifelong dependency on third</td>
</tr>
<tr>
<td></td>
<td>party care for basic needs</td>
</tr>
<tr>
<td></td>
<td>- Significantly reduced life expectancy</td>
</tr>
<tr>
<td>Medium likelihood of harm</td>
<td>Harm category 2</td>
</tr>
<tr>
<td>Low likelihood of harm</td>
<td>Harm category 3</td>
</tr>
</tbody>
</table>
Harm Category is established from “seriousness of harm risked” and “likelihood of harm occurring”

<table>
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<tr>
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<th>Harm category 1</th>
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<td>Harm category 2</td>
</tr>
<tr>
<td>Low likelihood of harm</td>
<td>Harm category 3</td>
</tr>
</tbody>
</table>
Likelihood (Probability) of Harm

- Likelihood of harm depends on:
  - Exposure level and duration

- Can be expressed in fibre/ml.years
  - "Cumulative dose"

- Is derived from risk models (e.g., Hodgson and Darnton)
  - Models have established the probability of harm arising based on cumulative doses
  - Based on historical data
Likelihood of disease is based on dose (cumulative exposure)
Uncertainty in Models: Caveats!!

• Even if exposures for an incident are known with reasonable confidence, risk predictions will still encompass considerable uncertainty from the risk models themselves.

• The calculated numbers suggest a particular level of accuracy but the results are never definitive and will always have a large degree of uncertainty.
Lifetime risk in relation to cumulative asbestos exposure accrued over 5 years from age 30 based on Hodgson and Darnton 2000

**Lower doses**

Mesothelioma lifetime risk by cumulative exposure (amosite) $0.13 \times 0.75 + 0.0006 \times 2.1$

Uncertainty relative to central estimate higher at low doses

**Higher doses**

Mesothelioma lifetime risk by cumulative exposure (amosite) $0.13 \times 0.75 + 0.0006 \times 2.1$

Range of cumulative exposures in original epidemiology studies ~10-100 f/ml/yr
Sentencing Guidelines: Likelihood of Harm: RRA

• Currently: No guidance on what “Low, Medium and High” means quantitatively

• Likely to be inconsistency re application of the 3-level categorisation

• Typically it is concluded that the likelihood of harm is low

• This paper suggests establishing quantitative boundaries between:
  – Low and medium risk
  – Medium and high risk

• Purpose: to seek to ensure “appropriate” level of risk is applied
Sentencing Guidelines
Suggested Boundaries: Low-medium risk

- **Lifetime risk of developing mesothelioma spontaneously (with no asbestos exposure) estimated as**
  - 1 in 10,000 (0.01%) (equivalent to 50-100 mesotheliomas per year)

- **An additional risk of 1 in 10,000 (ie on top of the spontaneous background risk) effectively**
  - **Doubles** the overall risk and therefore “materially increases the risk” (0.02%)

- **This is a natural boundary for low to medium risk**
Low-medium Boundary:
Risk is at-least doubled: “Material increase”

“Medium risk”: Exposure has at least doubled the background risk

“Low risk”: Exposure is less than double the background risk
• A lifetime risk of developing mesothelioma of 1 in 1000 (0.1%):  
  – is 10-fold higher than risk of spontaneously developing mesothelioma

• This is the level of risk seen in high risk jobs in the past

• This forms a natural boundary between medium and high risk
Boundaries: Low-medium-high risk

Example for illustrative purposes only
<table>
<thead>
<tr>
<th>Likelihood category</th>
<th>Lifetime risk</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>1 in 1000 or higher</td>
<td>Risk consistent with that seen in high risk jobs in the past</td>
</tr>
<tr>
<td>Medium</td>
<td>1 in 10,000 to &lt;1 in 1000</td>
<td>Risk is at least doubled but less than the risks observed in for work in high risk jobs in the past</td>
</tr>
<tr>
<td>Low</td>
<td>Less than 1 in 10,000</td>
<td>Additional risk due to asbestos less than doubles the spontaneous risk</td>
</tr>
</tbody>
</table>
Application of the boundaries using risk model exposure cumulative dose data

Table 1: Cumulative exposure bands for which lifetime risks are High (H), Medium (M) or Low (L) by fibre type

<table>
<thead>
<tr>
<th>Cumulative exposure (f/ml.yrs)</th>
<th>Crocidolite</th>
<th>Amosite</th>
<th>Chrysotile</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 or more</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>0.5 to &lt;10</td>
<td>H</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>0.2 to &lt;0.5</td>
<td>H</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>0.02 to &lt;0.2</td>
<td>H</td>
<td>M</td>
<td>L</td>
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<tr>
<td>0.01 to &lt;0.02</td>
<td>M</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>0.001 to &lt;0.01</td>
<td>M</td>
<td>L</td>
<td>L</td>
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<tr>
<td>&lt;0.001</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>
Amosite: Low, Medium and High lifetime risks of asbestos-related cancer according to exposure level and duration (\(= f/\text{ml.yrs}\))

<table>
<thead>
<tr>
<th>Level (f/ml)</th>
<th>Duration</th>
<th>Weeks</th>
<th>Days</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>12</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>5</td>
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<tr>
<td>0.5</td>
<td>1</td>
<td>5</td>
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<td>0.2</td>
<td>0.5</td>
<td>5</td>
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<td>0.1</td>
<td>0.2</td>
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Suggested Boundaries: Benefits

- Should help to improve consistency in determining harm categories in sentencing guidelines to assist the courts.
- Should reduce unsubstantiated claims of low risk.

But also need to ensure that:

- The “dose” is correctly/accurately assessed:
  - Will need best quality information on exposure levels and duration.
- The appropriate level of culpability is assigned:
  - Serious failures in compliance have occurred.
Typical airborne asbestos fibre concentrations associated with AIB activities

<table>
<thead>
<tr>
<th>AIB Activity</th>
<th>Likely Fibre Concentrations (f/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling overhead</td>
<td>5-10</td>
</tr>
<tr>
<td>Drilling vertical columns</td>
<td>2-5</td>
</tr>
<tr>
<td>Cutting with circular saw</td>
<td>&gt; 20</td>
</tr>
<tr>
<td>Cutting with jig saw</td>
<td>5-20</td>
</tr>
<tr>
<td>Hand sawing</td>
<td>5-10</td>
</tr>
<tr>
<td>Hand cutting</td>
<td>1-12</td>
</tr>
<tr>
<td>Breaking and ripping out</td>
<td>5-20</td>
</tr>
</tbody>
</table>

References: Guidance Note EH71 published 1996 (Now succeeded by HSG247 “Asbestos, the Licensed Contractors’ Guide)). Highest concentrations expected where amosite is present. Footnote in Document: “Bad handling practices may result in much higher dust concentrations”
Culpability (Extent of compliance): 4 Categories

- **Very high:** Deliberate breach of or flagrant disregard for the law

- **High:** Offender fell far short of appropriate standard eg by:
  - Failing to put in place measures that are recognised standards in the industry
  - Ignoring concerns
  - Allowing breaches to subsist over a long period

- **Medium:** Offender fell short of standard:
  - Falls between "high" and "low"
  - Systems in place but these were not sufficiently adhered to or implemented

- **Low:** Offender did not fall far short of standard eg because:
  - Significant efforts made to address the risk but were inadequate on this occasion
  - There was no warning/circumstance indicating a risk to H&S
  - Failings minor/occurred as an isolated incident
Final Comments

• Suggested boundaries will help to improve consistency in determining harm categories in sentencing guidelines to assist the courts

• RRA can provide re-assurance in single incidents

• RRA should not divert attention from legal duties
  – Employers must always focus on preventing/reducing exposure and spread
Finally:
HSE website: www.hse.gov.uk/asbestos

- Best to avoid incidents altogether
- Asbestos App..... Web/mobile/Tablet